SULPHUR PELLET COMPRISING H_2S-SUPPRESSANT

FIELD OF THE INVENTION

The invention relates to a sulphur pellet. The invention further relates to a process for the manufacture of sulphur pellets. The invention also relates to a process for the manufacture of a sulphur-comprising asphalt paving mixture using sulphur pellets according to the invention.

BACKGROUND OF THE INVENTION

In the road construction and road paving industry, it is a well-practised procedure to coat aggregate material such as sand, gravel, crushed stone or mixtures thereof with hot fluid bitumen, spread the coated material as a uniform layer on a road bed or previously built road while it is still hot, and compact the uniform layer by rolling with heavy rollers to form a smooth surfaced road.

The combination of bitumen with aggregate material, such as sand, gravel, crushed stone or mixtures thereof, is also referred to as "asphalt". Bitumen, also referred to as "asphalt binder", is usually a liquid binder comprising asphaltenes, resins and solvents. Bitumen can for example comprise pyrogenous mixtures derived from petroleum residues such as residual oils, tar or pitch or mixtures thereof.

It is known in the art that sulphur can be mixed with bitumen for applications in the road construction and road paving industry.

In US 2003/073761 A1 a composition comprising sulphur, a thermoplastic elastomer and tetramethythiuram

disulfide is described.

In GB-A-2, 384,240 a composition comprising sulphur in the range of from 0.01 to 2 wt%) is described.

In DE 110,58,712 A1 a composition comprising 18.4 wt% of elemental sulphur) is described.

Efforts towards improving the addition of sulphur to bitumen are for example described in GB 1,528,384. More recently, studies on the use of sulphur in bituminous mixtures have indicated that the

use of sulphur-modified bitumen is feasible. Sulphur-modified bitumen is formulated by replacing some of the bitumen in conventional binders by elemental sulphur.

One of the problems encountered when using sulphur in bitumen is the unwanted formation of H_2S, resulting from dehydrogenation reactions between bitumen and sulphur at high temperatures.

Even low H_2S emission from sulphur-comprising asphalt, meaning asphalt formulated using sulphur-modified bitumen wherein elemental sulphur has been used to replace part of the bitumen, presents an emission nuisance on road paving projects. This is due to the gradual H_2S gas concentration increase to high levels in the air voids in the loose paving mixture during storage in silos and during truck delivery to the paving site. The "stored" gas is released when the air pockets in the mixture are opened up as the mixture is dumped from the delivery trucks or as the mixture is subjected to mechanical mixing.

In view of the substantial amounts of sulphur used, especially in sulphur-comprising asphalt having high sulphur-bitumen weight ratios, e.g. as high as 1:1, H_2S emission is a serious problem. Therefore, it is necessary to reduce the unwanted formation and emission of H_2S from sulphur-comprising asphalt.

In Patent abstracts of Japan, vol. 2000, no. 20, 2001-07-10 a method for reducing H_2S formation during vulcanization is described. No reference is made to sulphur-bitumen mixtures.

One method to reduce H_2S-emission from hot cast sulphur-asphalt mixtures is to add an H_2S-suppressant in the process to manufacture sulphur-bitumen mixtures by

mixing and heating sulphur and bitumen in the presence of added H_2S-suppressant as described in US 3,960,585 and in EP-A-121,377.

A disadvantage of the method described in US 3,960,585 is that liquid H_2S-suppressant has to be

injected into paving mixture at the mixing plant. Consequently, equipment for injecting has to be set up and maintained at the mixing plant, making the process cumbersome and costly. Another disadvantage is that it is more difficult to achieve a homogeneous distribution of H_2S-suppressant in the paving mixture, as a relatively small amount of liquid H_2S-suppressant is added to a relatively large mixture of solids and liquids.

SUMMARY OF THE INVENTION

It has now been found that sulphur pellets comprising H_2S-suppressant can be successfully used in a process for the manufacture of a sulphur-comprising asphalt paving mixture.

The invention provides a sulphur pellet comprising at least one H_2S-suppressant, comprising in the range of from 60 to 100 wt% elemental sulphur, based on the total weight of the pellet. The sulphur pellet according to the invention offers the advantage that when it is used in any process where the aim is to achieve a suppression of H_2S formation or emission, the efficiency of the H_2S-suppressant will be higher because the H_2S-suppressant will already be close to the source of H_2S formation, namely the sulphur.

The invention further provides a process for the manufacture of sulphur pellets according to the invention, the process comprising the steps of:
(a) mixing elemental sulphur, one or more H_2S-suppressants and optionally a filler in a mixing unit to obtain a mixture;

(b) shaping and/or pelletising the mixture obtained in step (a) in a pelletising unit to obtain H_2S-suppressant-comprising sulphur pellets.

The invention also provides a process for the manufacture of a sulphur-comprising asphalt paving mixture using H_2S-suppressant comprising sulphur pellets according to the invention. The process comprises the

regularly sized particle, for example flakes, slates or sphere shaped sulphur such as prills, granules, nuggets and pastilles or half pea sized sulphur.

~~Typically, t~~The sulphur pellet comprises in the range of from 60 to (and including) 100 wt%, preferably from 75 to (and including) 100 wt% and more preferably from 90 to (and including) 100 wt% of elemental sulphur, based on the total weight of the pellet.

Reference herein to an H_2S-suppressant is to a compound capable of suppressing the formation or emission of H_2S. Typical H_2S-suppressants are compounds selected from the class of free radical inhibitors and redox catalysts. Preferred H_2S-suppressants are selected from the group of tetra-alkyl-thiuram disulfide, dithiocarbamates, especially zinc dialkyl dithiocarbamates, amine compounds, iodine, copper salts, copper oxides, cobalt salts, cobalt oxides, iron oxides and iron salts.

Preferred iron salts are iron chloride compounds, in particular those iron chloride compounds selected from the group of ferric chloride, hydrated ferric chloride, ferrous chloride and hydrated ferrous chloride. Hydrated ferrous chloride is the most preferred, because of its greater effectiveness as an H_2S-suppressant and because of its non-corrosivity.

The sulphur pellet comprising H_2S-suppressant according to the invention typically comprises H_2S-suppressant in amounts in the range of from 0.02% to 10% (w/w), preferably from 0.05% to 6.5%, more preferably from 0.1% to 2.0%, based on the total pellet.

Typically, the H_2S-suppressant is distributed homogeneously throughout the sulphur pellet.

The formation of H_2S originates from sulphur. An important advantage of the sulphur pellets comprising